PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-153026
(43)Date of publication of application : 16.06.1995

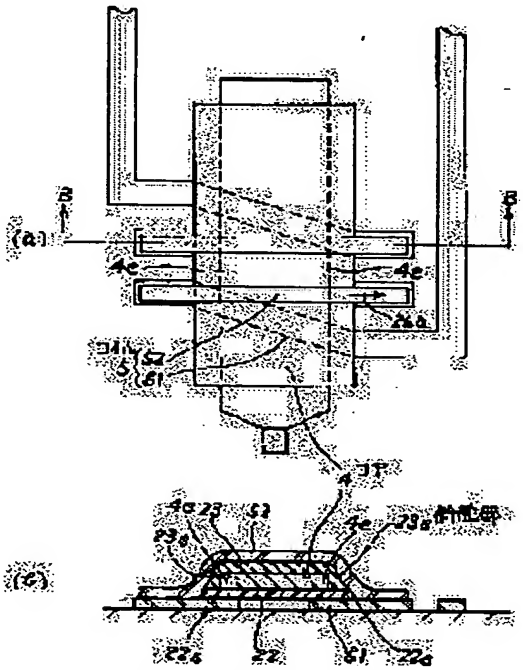
(51)Int.Cl. G11B 5/31

(21)Application number : 05-295121
(22)Date of filing : 25.11.1993

(71)Applicant : FUJITSU LTD
(72)Inventor : TAKAHASHI YOSHIO

(54) THIN-FILM MAGNETIC HEAD AND MAGNETIC DISK DEVICE

(57)Abstract:
PURPOSE: To prevent the shape defect of a photo-resist mask from occurring due to reflected light from a plated base by crossing an upper coil pattern and the both-sides edge part of a core on the inclination part of upper and lower insulating layers.
CONSTITUTION: Insulating layers 23, 22 are held between the upper part and the lower part of a magnetic-material core 4, and both ends of lower and upper coil patterns 51, 52 crossing across the core 4 are connected to form a spiral coil 5. The pattern 51, the insulating layer 22, the core 4, the insulating layer 23 and the pattern 52 are laminated in order to constitute a thin-film magnetic head. In the inclination parts 22s, 23s on both sides of the layers 22, 23, the pattern 52 is arranged so that it vertically crosses across the both-sides edge 4e of the core. The direction 26a of reflected light from the plated base to form the pattern 52 is vertical to the edge of the core, so that a square shape does not become defect. As a result, the region to be exposed between adjacent coil patterns is exposed to light to make large a window hole, so that the short-circuit generated between the adjacent coil patterns can be prevented.



LEGAL STATUS

[Date of request for examination] 05.09.1997
[Date of sending the examiner's decision of rejection] 10.11.1998
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] The lower coil pattern 51 which intersects this core 4 on both sides of a lower insulating layer at the core 4 bottom of magnetic material, Connect ends with the up coil pattern 52 which intersects this core 4 on both sides of an up insulating layer at this core 4 upside, and it comes to constitute the spiral coil 5. It is the thin film magnetic head which it comes to form in order of the lower coil pattern 51, the lower insulating layer 22, a core 4, the up insulating layer 23, and the up coil pattern 52. The thin film magnetic head characterized by the up coil pattern 52 crossing vertically to core edges-on-both-sides 4e on at least one of the two of the slant surface parts 22S and 23S of the both sides of the insulating layers 22 and 23 of the aforementioned upper and lower sides.
[Claim 2] Said up coil pattern 52 is the thin film magnetic head according to claim 1 which is a straight line-like and is characterized by crossing vertically to core edges-on-both-sides 4e covering an overall length.
[Claim 3] The lower coil pattern 51 which intersects this core 4 on both sides of a lower insulating layer at the core 4 bottom of magnetic material, Connect ends with the up coil pattern 52 which intersects this core 4 on both sides of an up insulating layer at this core 4 upside, and it comes to constitute the spiral coil 5. It is the thin film magnetic head which it comes to form in order of the lower coil pattern 51, the lower insulating layer 22, a core 4, the up insulating layer 23, and the up coil pattern 52. While being formed to the ends of the lower coil pattern 51, at least one of the two of the insulating layers 22 and 23 of the aforementioned upper and lower sides The thin film magnetic head characterized by having the window hole which connects the ends of an up coil pattern, and the ends of a lower coil pattern on the lower coil pattern 51, and connecting the ends of an up coil pattern to the ends of a lower coil pattern through said window hole.
[Claim 4] The lower coil pattern 51 which intersects this core 4 on both sides of a lower insulating layer at the core 4 bottom of magnetic material, Connect ends with the up coil pattern 52 which intersects this core 4 on both sides of an up insulating layer at this core 4 upside, and it comes to constitute the spiral coil 5. It is the thin film magnetic head which it comes to form in order of the lower coil pattern 51, the lower insulating layer 22, a core 4, the up insulating layer 23, and the up coil pattern 52. In the one of the two [at least] top of the slant surface parts 22S and 23S of the insulating layers 22 and 23 of the aforementioned upper and lower sides While the up coil pattern 52 is formed so that it may cross vertically to core edges-on-both-sides 4e, and at least one of the two of the insulating layers 22 and 23 of the aforementioned upper and lower sides is moreover formed to the ends of the lower coil pattern 51 It is the thin film magnetic head characterized by having the window hole which connects the ends of an up coil pattern, and the ends of a lower coil pattern, and connecting the ends of an up coil pattern, and the ends of a lower coil pattern through said window hole.
[Claim 5] The lower coil pattern 51 which intersects this core 4 on both sides of a lower insulating layer at the core 4 bottom of magnetic material, Connect ends with the up coil pattern 52 which intersects this core 4 on both sides of an up insulating layer at this core 4 upside, and it comes to constitute the spiral coil 5. It is the thin film magnetic head which it comes to form in order of the lower coil pattern 51, the lower insulating layer 22, a core 4, the up insulating layer 23, and the up coil pattern 52. Said up coil pattern 52 Covering an overall length, it is a straight line-like and crosses vertically to core edges-on-both-sides 4e. Moreover, at least one of the two of the insulating layers 22 and 23 of the aforementioned upper and lower sides It is the thin film magnetic head which has the window hole which connects the ends of an up coil pattern, and the ends of a lower coil pattern while being formed to the ends of the lower coil pattern 51, and is characterized by connecting the ends of an up coil pattern, and the ends of a lower coil pattern through said window hole.
[Claim 6] The magnetic disk drive which the thin film magnetic head of either of claims 1-5 is mounted in the carriage in a magnetic disk drive, and is characterized by having the composition of recording / reproducing information at a magnetic disk.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the thin film magnetic head and the magnetic disk drive of the coil pattern of the shape of stripes formed in the core bottom of magnetic material, and the coil pattern of the shape of stripes formed in the upside which connect ends and come to form a spiral coil.
[0002] By setting to the magnetic disk drive used as external storage in information processing system, as for the magnetic head which records / reproduces information, the thing of a thin film mold has spread instead of an ordinary monolithic mold from the request of the densification of informational recording density.
[0003] Moreover, also in the magnetic head of a thin film mold, the miniaturization is progressing quickly. For example, it considers as the structure which rolled the spiral coil by the thin film technology at the core of magnetic material, a magnetic pole is formed in this core and right angle, and the thin film magnetic head which carries out the pressure welding of the magnetic pole head to the magnetic-recording medium of a vertical recording mold is developed as indicated by JP,5-197924,A etc. However, as for this micro thin film magnetic head, the manufacture approach is not yet established.
[0004]
[Description of the Prior Art] Drawing 8 is the thin film magnetic head carried by JP,5-197924,A, and the magnetic-head component section 2 has structure which connected the coil 5 to the core 4 which consists of the magnetic substance by the thin film technology, and connected the lead pattern 6 of winding and this coil 5 to the bonding pad 8 of the bottom (installation section) 7 of the spring arm section 1.
[0005] The magnetic pole 9 prolonged in the magnetic-disk D side is connected at the head of a core 4, and the back end yoke 10 prolonged in the magnetic-disk D side as well as the back end is formed in it. And the return yoke 11 is connected to the back end yoke 10 at a core 4 and parallel. In addition, laminating formation of the above each part is carried out one by one by the thin film technology.
[0006] This thin film magnetic head is in the condition that the sliding surface 3 at a head is in contact with magnetic-disk D which is rotating in the direction of an arrow head, and if an information signal is energized in a coil 5, since the magnetic flux 12 between a magnetic pole 9 and the return yoke 11 will penetrate the inside of magnetic-disk D, the vertical magnetic pole record of it is attained. Moreover, since record/playback is performed by the single magnetic pole 9, it is also called the thin film magnetic head of a single magnetic pole mold.
[0007] Drawing 13 is the perspective view showing the interior of the small magnetic disk drive which mounted this thin film magnetic head; and the bottom section 7 of the spring arm 1 is attached in the actuation arm A2 fixed to the revolving shaft A1 of carriage. Therefore, the head component section 2 at the head of the spring arm 1 carries out both-way migration radial [of magnetic-disk D], and seek operation is performed because the carriage revolving shaft A1 carries out a both-way revolution.
[0008] After forming drawing 9 in order of the sliding heights 13, the return yoke 11, the lower coil pattern 51, a lower insulating layer, the layer of a core 4, an up insulating layer, the up coil pattern 52, and the insulating protective layer 14, it polishes a head to common, it is the sectional view expanding and showing the point of the aforementioned thin film magnetic head, it is in the condition in which the head of a core 4 was exposed, and after carrying out patterning to the order of the main pole 91 and the auxiliary magnetic pole 92 it forms a protective coat 15. Finally, the sliding surface of the sliding heights 13 is polished and the head of the main pole 91 is exposed.
[0009] By the thin film technology, in order to wind a coil 5 around a core 4, as shown in drawing 10, membrane formation and patterning are performed repeatedly. Drawing 10 is the top view and drawing of longitudinal section showing the core 4 of magnetic material, and the formation approach of the coil patterns 51 and 52 in order of a process. it is first shown in (1) — as — aluminum 2O3 etc. — from — after forming the plating base on the becoming insulating base 21, while forming the mask of a photoresist, forming Cu electric conduction film with plating and removing the mask of a photoresist, lower coil pattern 51 — is formed in the shape of stripes by removing the plating bases other than the coil section. In addition, 10 is a back end yoke currently formed beforehand.
[0010] Next, as shown in (2), in order to insulate between cores 4 with lower coil pattern 51 —, it is the lower coil pattern 51. — After forming the first insulating layer 22 in the direction which crosses upwards and forming the magnetic substance, such as a permalloy, on the whole surface on it, a core 4 is formed by carrying out ion mealing from a mask. In addition, the laminating of the back end of a core 4 is carried out on the back end yoke 10.
[0011] As shown in (3), in order to insulate between the coil patterns of a core 4 and an upside, a core 4 is covered

with an insulating material 23. At this time, it is each lower coil pattern 51. — Ends e1 are exposed. Next, as shown in (4), patterning of the upper coil pattern 52 is carried out to the shape of stripes in the same way as the lower coil pattern 51 on the second insulating layer 23.
[0012] At this time, patterning is carried out in the direction in which the up-and-down coil patterns 51 and 52 cross so that right end 2r of the upper coil pattern 52 may lap with right end 1r of the lower coil pattern 51 and left end 2L of the upper coil pattern 52 may lap with left end 1L of the following bottom coil pattern 51 1 pitch. Consequently, the coil 5 which continued spirally is formed with each lower coil pattern 51 and each upper coil pattern 52, and it becomes the configuration that the core 4 was inserted in inside. Finally, like drawing 9 , lap polishing is carried out until the head of a core 4 is exposed, and magnetic poles 91 and 92 are formed on core 4 head.
[0013] Although drawing 10 is illustrated typically, a actual cross-section configuration becomes like drawing 11. Although (a) of drawing 11 is a top view, the insulating base 21 is excluded drawing. A B-B sectional view [in / in (b) / (a) drawing] and (c) are the C-C sectional views in (a) drawing. (b) As shown in drawing, the edges 22S and 23S of the both sides of the lower insulating layer 22 or the up insulating layer 23 serve as an inclined plane, and as shown in (c) drawing, also as for the ends of the longitudinal direction of a core 4, insulating layers 22 and 23 serve as an inclined plane.
[0014] Moreover, in drawing 8 and drawing 9 , to the magnetic pole 9 being formed in a right angle to a core 4, as shown in (a) and (c) drawing of drawing 11, the main pole 91 and the auxiliary magnetic pole 92 can also be formed in the almost same field as the coil patterns 51 and 52, a core 4, etc.
[0015]
[Problem(s) to be Solved by the Invention] As mentioned above, while forming an about several micrometers coil pattern and removing the mask of a photoresist subsequently with plating where the mask of a photoresist is formed on the thin plating base 0.1 micrometers or less in order to form the lower coil pattern 51 and the upper coil pattern 52, an ion meal etc. removes the plating bases other than the coil section.
[0016] Drawing 12 is an exposure process for carrying out patterning of the up coil pattern 52, and a B-B sectional view [in / (a) and / in (b) / (a) drawing] and (c) are the top views showing the track of the reflected light at the time of exposure. [a top view] Where the laminating of a core 4 and the up insulating layer 23 is carried out on the lower insulating layer 22, the plating base 24 is formed in the whole surface by vacuum evaporationo of Cu etc., and the photoresist 25 is applied on it. And the mask m for exposing the film 25 of this photoresist is arranged, and it exposes by irradiating light from on Mask m.
[0017] In the case of this exposure, after passing exposure field 25e of the film 25 of a photoresist, the light 26 reflected with the plating base 24 in the slant surface parts 22S and 23S of the both sides of the lower insulating layer 22 or the up insulating layer 23 advances aslant, as shown in a top view (c), and is irradiated by the photoresist film 25 of fields other than an exposure field. Consequently, as shown in (d), photoresist mask 25m after development, the pattern width of face of the mask hole 31 spreads with the slant surface part 22S and 23S up side, pattern width of face becomes large on slant surface part 22S and 23S, and the up coil pattern 52 which carried out plating formation using this mask 25m also has a possibility of short-circuiting between adjoining coil patterns.
[0018] The technical technical problem of this invention prevents that the mask of a photoresist serves as a defect of shape by the reflected light from the plating base paying attention to such a problem, and aims at realizing the thin film magnetic head and a magnetic disk drive without fear of the short circuit between coil patterns.
[0019]
[Means for Solving the Problem] Claims 1-5 are invention of the thin film magnetic head, and claim 6 is invention of a magnetic disk drive which used these thin film magnetic heads. The lower coil pattern 51 which intersects this core 4 on both sides of a lower insulating layer at the core 4 bottom of magnetic material so that claim 1 may be illustrated to drawing 1 , Connect ends with the up coil pattern 52 which intersects this core 4 on both sides of an up insulating layer at this core 4 upside, and it comes to constitute the spiral coil 5. It is aimed at the thin film magnetic head which it comes to form in order of the lower coil pattern 51, the lower insulating layer 22, a core 4, the up insulating layer 23, and the up coil pattern 52.
[0020] And it is formed so that the up coil pattern 52 may cross vertically to core edges-on-both-sides 4e on at least one of the two of the slant surface parts 22S and 23S of the both sides of the up-and-down insulating layers 22 and 23.
[0021] It is formed so that the up coil pattern 52 in claim 1 may illustrate to drawing 1 (a), and claim 2 may have become straight line-like and may cross vertically to core edges-on-both-sides 4e not only covering a slant surface part 22S and 23S upside but covering an overall length moreover.
[0022] The lower coil pattern 51 which intersects this core 4 on both sides of a lower insulating layer at the core 4 bottom of magnetic material so that claim 3 may be illustrated to drawing 2 , Connect ends with the up coil pattern 52 which intersects this core 4 on both sides of an up insulating layer at this core 4 upside, and it comes to constitute the spiral coil 5. It is aimed at the thin film magnetic head which it comes to form in order of the lower coil pattern 51, the lower insulating layer 22, a core 4, the up insulating layer 23, and the up coil pattern 52.
[0023] And at least one of the two of the up-and-down insulating layers 22 and 23 is formed to the ends of the lower coil pattern 51, and the ends of the up coil pattern 52 are connected to the ends of the lower coil pattern 51 in the window hole formed on the lower coil pattern 51 between at least one of the two of the slant surface parts 22S and 23S of an insulating layer, and core edges-on-both-sides 4e.
[0024] Claim 4 is set like claim 1 on at least one of the two of the slant surface parts 22S and 23S of the up-and-

down insulating layers 22 and 23. The up coil pattern 52 is formed so that it may cross vertically to core edges-on-both-sides 4e. Moreover, like claim 3 A window hole is formed on the lower coil pattern 51 between the slant surface parts 22S and 23S of the up-and-down insulating layers 22 and 23, and core edges-on-both-sides 4e, and the ends of the up coil pattern 52 are connected to the ends of the lower coil pattern 51.
[0025] Like claim 2, claim 5 is formed so that the coil pattern 52 of the upside formed on the up insulating layer 23 may moreover cross vertically to core edges-on-both-sides 4e covering an overall length in the shape of a straight line. Like claim 3 A window hole is formed on the lower coil pattern 51 between the slant surface parts 22S and 23S of the up-and-down insulating layers 22 and 23, and core edges-on-both-sides 4e, and the ends of the up-and-down coil patterns 51 and 52 are connected.
[0026] Claim 6 is a magnetic disk drive with which the thin film magnetic head of either of claims 1-5 is mounted in the carriage in a magnetic disk drive, and has become a magnetic disk with the configuration which records / reproduces information.
[0027]
[Function] If it is formed like claim 1 so that the upper coil pattern 52 may cross vertically to core edges-on-both-sides 4e on slant surface part 22S of the both sides of the up-and-down insulating layers 22 and 23, and 23S, the reflected light by the plating base for forming this coil pattern 52 will be vertically reflected to marginal 4e of a core 4, as 26a shows to drawing 1 (a). Consequently, the field which should be exposed essentially between contiguity coil patterns and out of which it does not come is exposed, and the coil pattern with which the coil [that a mask window hole is large] pattern by which plating formation was passed over which and carried out adjoins, and a problem which short-circuits are solved.
[0028] Like claim 2, if it moreover crosses vertically to core edges-on-both-sides 4e covering the overall length of the coil pattern 52 of not only a slant surface part 22S and 23S upside but an upside in the shape of a straight line, in addition to the short circuit prevention between contiguity coil patterns, pattern formation will also become easy.
[0029] According to claim 3, the up-and-down insulating layers 22 and 23 are formed to the ends of the lower coil pattern 51, a window hole is formed between the insulating-layer slant surface parts 22S and 23S and core edges-on-both-sides 4e, and the ends of the up-and-down coil patterns 51 and 52 are connected. That is, since the coil pattern 52 is formed in the direction of slant (adjoining coil pattern side) in slant surface part 22S and 23 S-twist inside which generate the reflected light, the light for exposure is not irradiated by slant surface parts 22S and 23S. Consequently, the upside coil pattern 52 does not become thick and problems, such as a short circuit between coil patterns, are not produced, either.
[0030] Since it is formed like claim 4 so that the upper coil pattern 52 may cross vertically to core edges-on-both-sides 4e on at least one of the two of the slant surface parts 22S and 23S of the up-and-down insulating layers 22 and 23 By controlling not to receive the adverse effect of the reflected light as mentioned above, can form the mask pattern of a photoresist in accuracy and, moreover, the up-and-down insulating layers 22 and 23 are formed to the ends of the lower coil pattern 51. Since a window hole is formed between the slant surface parts 22S and 23S and core edges-on-both-sides 4e and the ends of the up-and-down coil patterns 51 and 52 are connected, the effect of the reflected light can be avoided more certainly.
[0031] Since the coil pattern 52 of the upside formed on the up insulating layer 23 is formed like claim 5 so that it may moreover cross vertically to core edges-on-both-sides 4e covering an overall length in the shape of a straight line In addition to the short circuit prevention between contiguity coil patterns, pattern formation also becomes easy and, moreover, forms the up-and-down insulating layers 22 and 23 to the ends of the lower coil pattern 51. Since a window hole is formed between the slant surface parts 22S and 23S and core edges-on-both-sides 4e and the ends of the up-and-down coil patterns 51 and 52 are connected, the effect of the reflected light can be avoided more certainly.
[0032] Since the short circuit between the coil patterns in the thin film magnetic head does not occur like claim 6 according to the configuration in which the thin film magnetic head of either of claims 1-5 is mounted in the carriage in a magnetic disk drive, the dependability at the time of recording / reproducing information improves to a magnetic disk.
[0033]
[Example] Next, an example explains how the thin film magnetic head and the magnetic disk drive by this invention are materialized on actual. Drawing 1 is the top view and B-B sectional view of the 1st example of the thin film magnetic head by this invention. This example is formed so that the upper coil pattern 52 may cross vertically to core edges-on-both-sides 4e.
[0034] the example of a graphic display — the overall length of the upper coil pattern 52 — crossing — the shape of a straight line — and although it crosses vertically to a core 4, only in the slant surface part 22S and 23S upside of the up-and-down insulating layers 22 and 23, it crosses vertically, and you may form aslant like drawing 11 in the flat field of a core 4 upside. moreover, the case where the slant surface parts 22S and 23S of the up-and-down insulating layers 22 and 23 have shifted — slant surface part [both] 22S and 23S upside — setting — vertical — you may cross — being certain — it is — yes, you may cross with the gap or one of the two up side.
[0035] Like drawing 1 , when the overall length of the upper coil pattern 52 crosses vertically to a core 4, it is patterning of the lower coil pattern 51 being carried out aslant, and the left ends of the up-and-down coil patterns 51 and 52 being connected, and connecting with the right end of the upper coil pattern 52 with which the right end of the lower coil pattern 51 adjoins, and the coil 5 which followed the surroundings of a core 4 spirally is formed.
[0036] The optimum size of each part in the thin film magnetic head of a graphic display example It is about 500

micrometers. Thickness:3-4micrometer, width-of-face:50-60micrometer, die length which are a core 4 : the up-and-down coil patterns 51 and 52 thickness: — 2-3-micrometer, pattern width-of-face:5micrometer, and die-length: — about 100 micrometers and 40 to number of turns:60 turn — it is — moreover, the up-and-down insulating layers 22 and 23 — thickness:2-3micrometer, width-of-face:70-80micrometer, and die-length: — it is about 400 micrometers.

[0037] In addition, the up-and-down coil patterns 51 and 52, formation of the up-and-down insulating layers 22 and 23, formation of a core 4, etc. are conventionally [which is shown in drawing 11] the same as the manufacture approach of the thin film magnetic head of structure.

[0038] In order to manufacture the thin film magnetic head of this example, the window hole of the photoresist mask for forming the upper coil pattern 52 on at least one of the two of the slant surface parts 22S and 23S of the up-and-down insulating layers 22 and 23 is formed so that it may cross vertically to core edges-on-both-sides 4e, and the upper coil pattern 52 is formed in the field of this window hole with a conductor.

[0039] Moreover, when the overall length of the upper coil pattern 52 makes it the structure which crosses at right angles to a core 4, covering an overall length, the window hole of the photoresist mask for forming the upper coil pattern 52 is formed so that it may cross vertically to core edges-on-both-sides 4e, and the upper coil pattern 52 is formed in the field of this window hole with a conductor.

[0040] Drawing 2 is the top view and sectional view showing another example of the thin film magnetic head by this invention. This example opens a window hole in the up-and-down insulating layers 22 and 23 between the slant surface parts 22S and 23S of the up-and-down insulating layers 22 and 23, and core edges-on-both-sides 4e, and has structure which connected the ends of the up-and-down coil patterns 51 and 52.

[0041] It is about 500 micrometers. the optimum size of each part in this example — thickness:3-4micrometer [of a core 4], width-of-face:50-60micrometer, and die-length: — the up-and-down coil patterns 51 and 52 thickness: — 2-3 micrometers, pattern width-of-face:5micrometer, die-length:100micrometer, and 40 to number of turns:60 turn — it is — moreover, the up-and-down insulating layers 22 and 23 — the example of drawing 1 — being different — thickness:2-3micrometer, width-of-face:110-120micrometer, and die-length: — it is about 400 micrometers.

[0042] Next, the manufacture approach of the thin film magnetic head of this example is explained in order of a process in drawing 3 thru/or drawing 7 . First, as shown in drawing 3 , in order to carry out patterning of stripes-like the bottom coil pattern 51 and the lead pattern 6 with copper selection plating and to form the lower insulating layer 22 on it on the insulating base 21, after carrying out the spin coat of the resin etc., negatives are exposed/developed and patterning of the lower insulating layer 22 is carried out.

[0043] At this time, the lower insulating layer 22 is extended and formed to an outside [ends / of the lower coil pattern 51], and the window holes 27 and 28 for connecting the ends of the up-and-down coil patterns 51 and 52 are opened on the ends of the lower coil pattern 51. Therefore, it will open in slant surface part 22S of the edges on both sides of the lower insulating layer 22, and 23 S-twist inside. And patterning of the core 4 which consists of magnetic material, such as a permalloy, on the lower insulating layer 22 is carried out in the direction which intersects each lower coil pattern 51.

[0044] Subsequently, as shown in drawing 4 , after carrying out the spin coat of the resin 23p for forming the up insulating layer 23 in the whole surface, negatives are exposed/developed, and as shown in drawing 5 , patterning of the up insulating layer 23 is carried out. Also at this time, the window holes 29 and 30 for connecting the ends of the up-and-down coil patterns 51 and 52 are formed on the window hole 27 of the lower insulating layer 22 formed by drawing 3 , and 28. That is, window holes 29 and 30 are formed in slant surface part 22S of the up-and-down insulating layers 22 and 23, and 23 S-twist inside.

[0045] Besides, electrical conducting materials, such as copper, are carried out the whole surface from the section insulating layer 23, a spatter is carried out, as shown in drawing 6 (1), vacuum evaporationo and where the plating base 24 is formed, as shown in (2), the spin coat of the photoresist 25 is carried out to the whole surface, and negatives are exposed/developed with the glass mask m, and mask 25m of a photoresist is formed like drawing 7 .

[0046] This mask 25m, since the mask for carrying out patterning of the upper coil pattern 52, the mask window hole 31 is carrying out the same configuration as the up coil pattern 52. If electroplating is performed from on this mask 25m, on the plating base 24 of a pars basilaris ossis occipitalis, copper plating will grow and the up coil pattern 52 of drawing 2 will be formed only for the inside of the mask window hole 31.

[0047] If dry cleaning dirty [of the plating base 24 of fields other than coil pattern 52] is carried out and an ion meal, a reverse spatter, etc. remove it after etching and removing mask 25m of the photoresist after carrying out plating formation to about several micrometers, the thin film magnetic head like drawing 2 will be completed.

[0048]

[Effect of the Invention] Since the upper coil pattern 52 crosses vertically to a core 4 on slant surface part 22S of the edge of the up-and-down insulating layers 22 and 23, and 23S as mentioned above according to the thin film magnetic head of this invention, the reflected light by the plating base can be controlled in the direction which does not have an adverse effect on mask pattern formation, and the short circuit between contiguity coil patterns can be prevented beforehand. Therefore, if this thin film magnetic head is mounted in the carriage of a magnetic disk drive, the dependability at the time of recording / reproducing information will improve to a magnetic disk.

[0049] Moreover, since light is not irradiated by slant surface parts 22S and 23S according to invention which forms the up-and-down insulating layers 22 and 23 to the ends of the lower coil pattern 51, forms a window hole between the slant surface parts 22S and 23S and core 4, and connects the ends of the up-and-down coil patterns 51 and 52, it does not generate but a poor mask pattern can prevent a coil pattern short circuit beforehand. Furthermore, if

invention of above both is used together, a poor mask pattern can be prevented more certainly.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

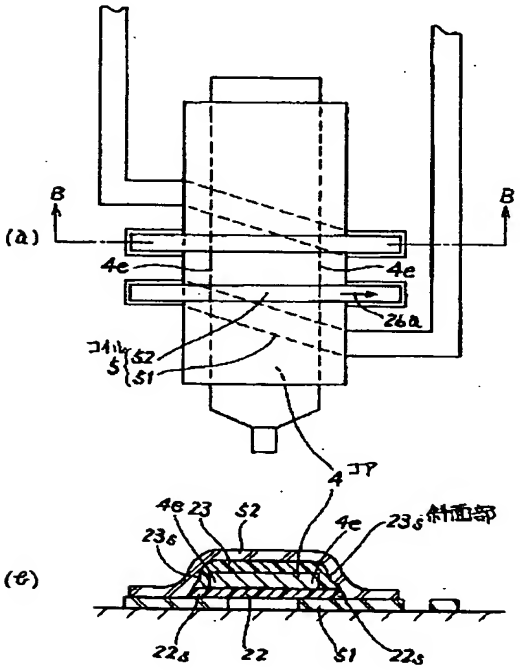
[Brief Description of the Drawings]
[Drawing 1] It is the top view and sectional view showing the 1st example of the thin film magnetic head by this invention.
[Drawing 2] It is the top view and sectional view showing the 2nd example of the thin film magnetic head by this invention.
[Drawing 3] It is the top view and sectional view which illustrate the lower insulating-layer patterning process in manufacture of the thin film magnetic head by this invention.
[Drawing 4] It is the sectional view which illustrates the spin coat process of the up insulating layer in manufacture of the thin film magnetic head by this invention.
[Drawing 5] It is the top view and sectional view which illustrate the up insulating-layer patterning process in manufacture of the thin film magnetic head by this invention.
[Drawing 6] It is the sectional view which illustrates the plating base membrane formation process and photoresist spreading process in manufacture of the thin film magnetic head by this invention.
[Drawing 7] It is the top view and sectional view which illustrate the patterning process of the photoresist mask in manufacture of the thin film magnetic head by this invention.
[Drawing 8] It is type section drawing which illustrates the whole thin film magnetic-head structure.
[Drawing 9] It is the sectional view expanding and showing the point of the thin film magnetic head of drawing 8 .
[Drawing 10] It is the top view and drawing of longitudinal section showing the core of magnetic material, and the formation approach of a coil pattern in order of a process.
[Drawing 11] It is the top view and sectional view showing the core of the thin film magnetic head, and the conventional configuration of the coil section.
[Drawing 12] It is drawing showing the trouble at the time of the conventional thin film magnetic-head manufacture.
[Drawing 13] It is the perspective view showing the interior of the small magnetic disk drive which mounted the thin film magnetic head.
[Description of Notations]
4 Core
5 Thin Film Coil
51 Lower Coil Pattern
52 Up Coil Pattern
21 Insulating Base
22 Lower Insulating Layer
23 Up Insulating Layer
22S Slant surface part of the edge of a lower insulating layer
23S Slant surface part of the edge of an up insulating layer
24 Plating Base
25 Film of Photoresist
25m Mask made from a photoresist
26 Reflected Light of the Direction of Slant
26a The vertical reflected light
27 28 Window hole which was able to be opened in the lower insulating layer
29 30 Window hole which was able to be opened in the up insulating layer
31 Window Hole for Coil Pattern Plating of Photoresist Mask

[Translation done.]

DRAWINGS

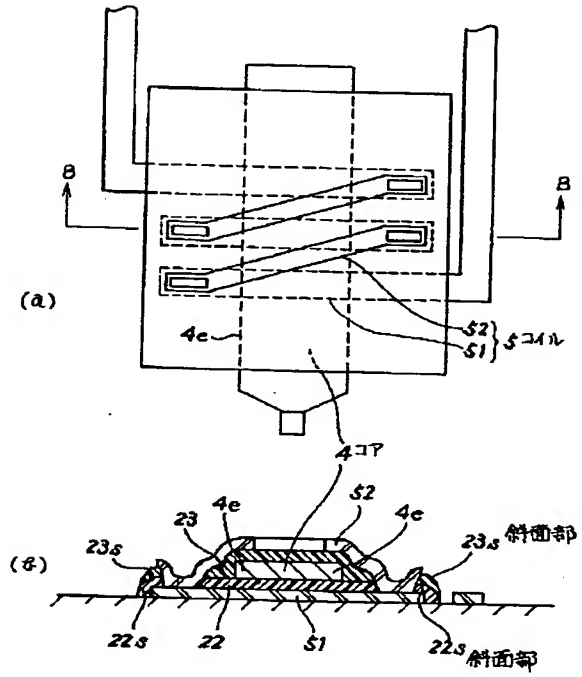
[Drawing 1]

本発明薄膜磁気ヘッドの第1実施例



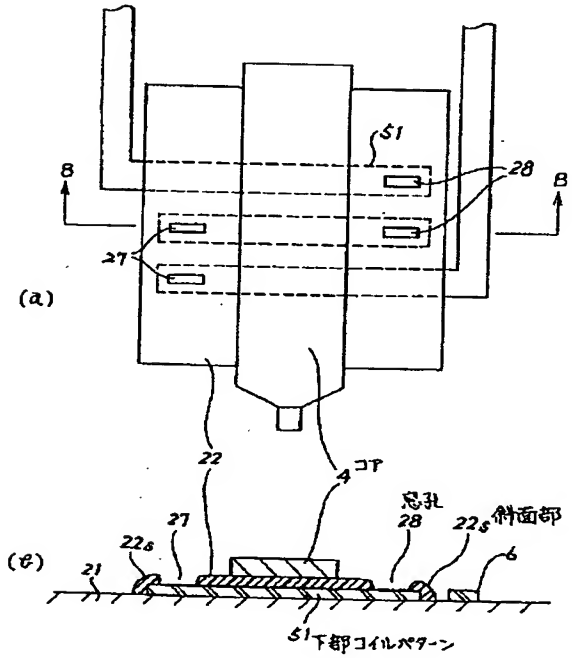
[Drawing 2]

本発明薄膜磁気ヘッドの第2実施例



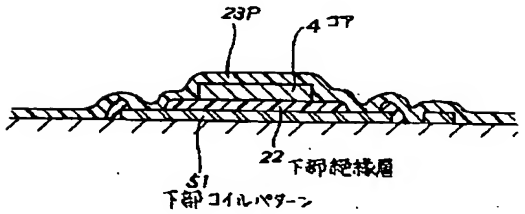
[Drawing 3]

下部絶縁層パターニング工程



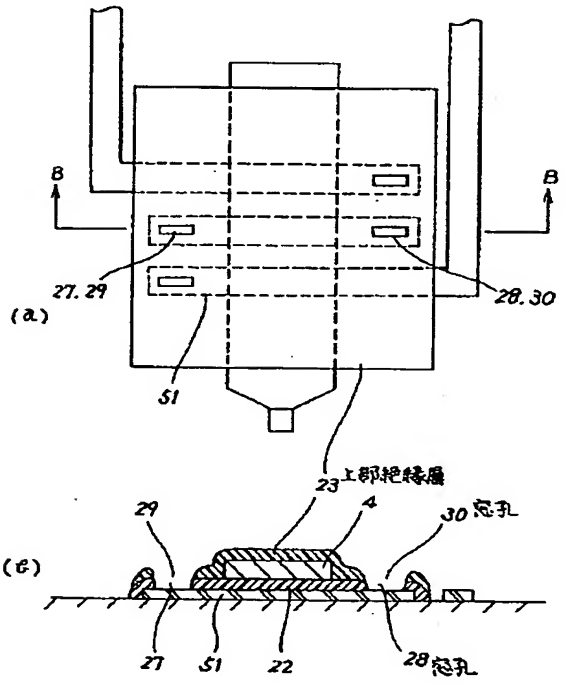
[Drawing 4]

上部絶縁層のスピンコート工程



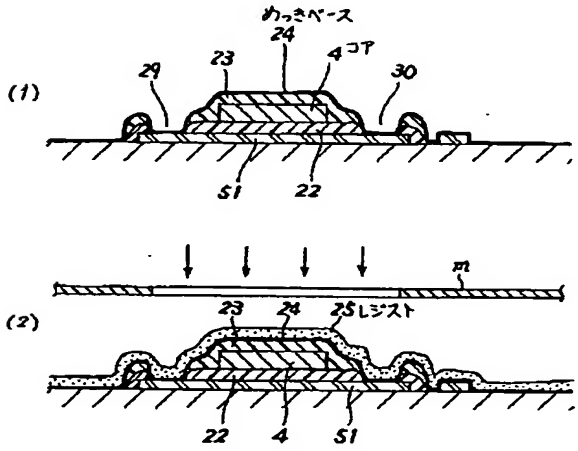
[Drawing 5]

上部絶縁層パターニング工程



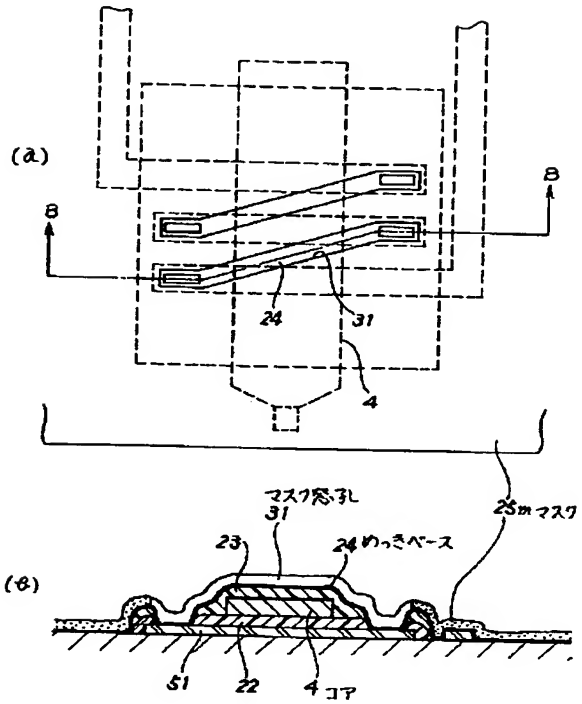
[Drawing 6]

めっきベース成膜工程とフォトレジスト塗布工程



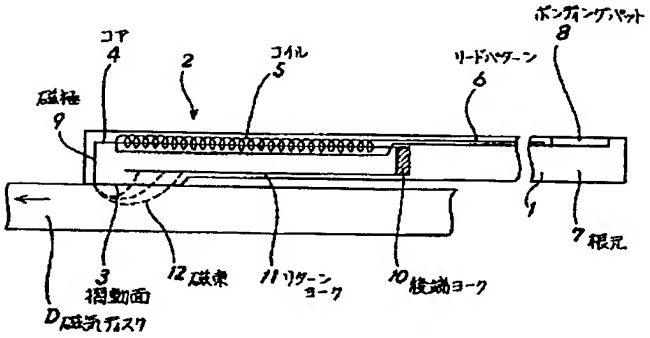
[Drawing 7]

フォトレジストマスクのパターニング工程



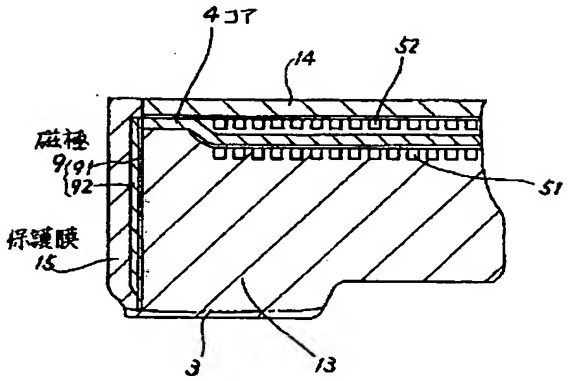
[Drawing 8]

一体型薄膜ヘッドの断面図



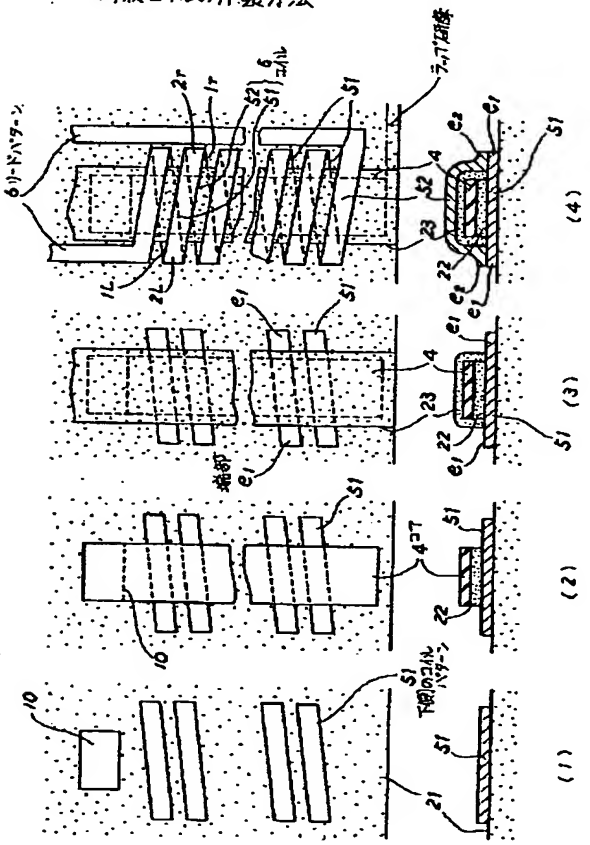
[Drawing 9]

先端部の拡大断面図



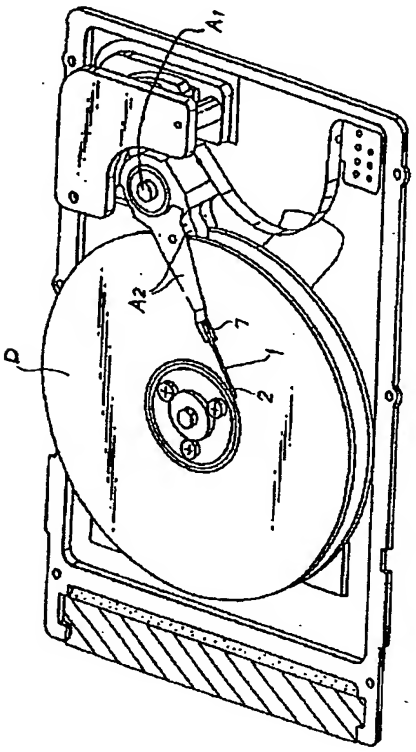
[Drawing 10]

薄膜コイルの作製方法



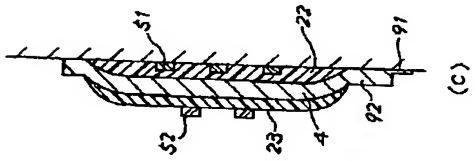
[Drawing 13]

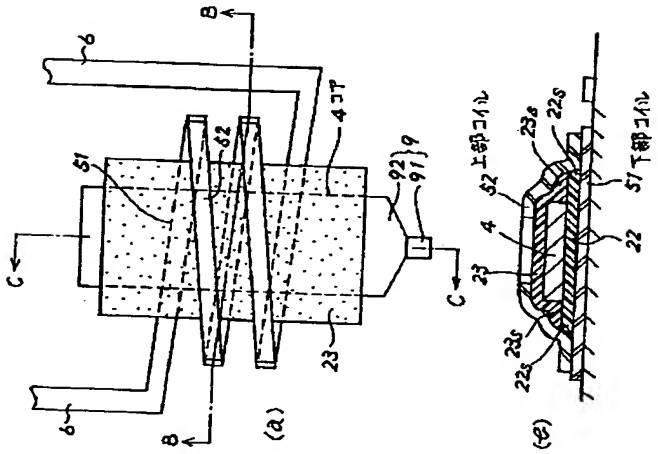
薄膜磁気ヘッドを実装した小型磁気ディスク装置



[Drawing 11]

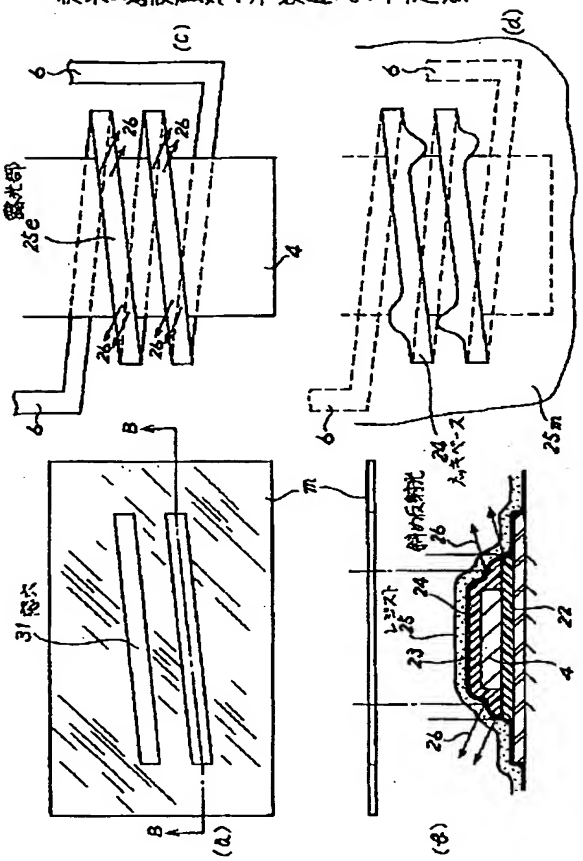
薄膜磁気ヘッドの従来構成





[Drawing 12]

従来の薄膜磁気ヘッド製造時の問題点



[Translation done.]